

REMARKS

Claims 1-4, 6-11, and 13-28 were examined and rejected. Applicants amend claims 1, 4, 6, 9, 13, 15-16, 18, 20, and 23-28. Applicants also cancel claim 7. Applicants respectfully request reconsideration of claims 1-4, 6, 8-11, and 13-28 as amended in view of at least the following remarks.

I. Claims Rejected Under 35 U.S.C. §112

The Patent Office rejects claims 26-28 under 35 U.S.C. § 112, first paragraph because there is no description in the Specification as originally filed of the use of hydrogen peroxide only.

Although Applicants disagree with the Patent Office's interpretation of the claim, the rejection identified above is moot. Applicants amend claims 26-28 to require "hydrogen peroxide and water," and assert that this limitation is supported by the specification as originally filed. Therefore, Applicants request that the Patent Office withdraw the rejection identified above.

II. Claims Rejected Under 35 U.S.C. §102(e)

The Patent Office rejects claims 9-11, 15, 24, and 27 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,159,858 to Kishii et al (Kishii). It is axiomatic that to be anticipated, every element of a claim must be disclosed within a single reference.

Applicants respectfully disagree with the rejection of independent claim 9 and submit that claim 9, as amended, is allowable for at least the reason that Kishii does not describe "spraying a solution comprising hydrogen peroxide onto the surface of the metal plug; wherein spraying includes driving at least one particle off the surface of the metal plug with the solution," as required by amended independent claim 9. Specifically, according to amended claim 9, for example, a particle on the surface of a metal plug may be driven off that surface by spraying a solution of hydrogen peroxide onto the surface.

On the other hand, Kishii describes a cleaning process “conducted in hydrogen peroxide and an acid” (col. 4, lines 3-7). In addition, Kishii describes a test piece “immersed” into a solution including hydrogen peroxide “followed by a scrubbing process” (see col. 9, lines 9-22). Finally, Kishii describes “an acid cleaning process” using a cleaning solution “used as described already.” (See col. 14, lines 53-60.) Therefore, one skilled in the art would not conclude that the description in Kishii of a cleaning process “conducted in hydrogen peroxide and an acid” or requiring a test piece “immersed” into a solution including hydrogen peroxide, discloses spraying a solution of hydrogen peroxide onto the surface of a metal plug and driving a particle off of the surface with the sprayed solution.

Consequently, the Patent Office has not identified and Applicants are unable to find any description in Kishii of spraying a solution comprising hydrogen peroxide onto the surface of a metal plug, as required by Applicants’ amended claim 9. Moreover, Applicants are unable to find any description in Kishii of driving at least one particle off of the surface of the metal plug with the solution, as also required by Applicants’ amended independent claim 9. Hence, applicants respectfully request the Patent Office withdraw the rejection identified above for at least these two reasons.

Applicants submit that dependent claims 10-11 and 13-17 being dependent upon allowable base claim 9, as amended, are patentable over the cited references for at least the reasons explained above. Thus, Applicants respectfully request that the Patent Office withdraw the rejection of dependent claims 10-11 and 13-17 under 35 U.S.C. § 102(e) as being anticipated by Kishii.

Applicants respectfully disagree with the rejection above with respect to independent claim 24 and submit that independent claim 24, as amended, is allowable for at least the reason that Kishii does not describe “introducing a solution comprising hydrogen peroxide over the surface of the metal plug through a polisher; rinsing the surface of the metal plug with the solution, wherein rinsing includes driving at least one particle off the surface of the metal plug with the solution and the polisher,” as required by amended independent claim 24. Specifically, according to amended claim 24, for example, a polisher may be used to introduce a solution having hydrogen peroxide

over a surface of a metal plug so that the solution and polisher drive a particle off of that surface.

On the other hand, as noted above with respect to claim 9, Kishii describes a cleaning process conducted in hydrogen peroxide, or having a test piece immersed in hydrogen peroxide.

Consequently, the Patent Office has not identified and Applicants are unable to find any description in Kishii of introducing a solution having hydrogen peroxide through a polisher or driving a particle off a surface with the solution and polished, as required by amended independent claim 24. Specifically, one skilled in the art would not conclude that the description in Kishii of a cleaning process "conducted in hydrogen peroxide and an acid" or requiring a test piece "immersed" into a solution including hydrogen peroxide, discloses introducing a solution through a polisher or driving a particle off a surface with the solution and the polisher. Hence, Applicants respectfully request that Patent Office withdraw the rejection identified above of amended independent claim 24.

In addition, Applicants respectfully disagree with the rejection above of independent claim 27 and submit that claim 27, as amended, is allowable for at least the reason that Kishii does not describe "introducing a solution consisting of hydrogen peroxide and water onto the surface of a metal plug, wherein introducing includes one of spraying the solution onto the surface and introducing the solution into the surface through a polisher, and wherein introducing includes driving at least one particle off the surface with the solution," as required by amended independent claim 27. To address the above-noted limitations, arguments analogous to those provided above with respect to claims 9 and 24 apply. Specifically, the Patent Office has not identified and Applicants are unable to find any description in Kishii of either spraying a solution of hydrogen peroxide onto a surface or introducing a solution of hydrogen peroxide through a polisher onto a surface, and driving a particle off of the surface with the solution. Hence, Applicants respectfully request the Patent Office withdraw the rejection of independent claim 27 cited above.

III. Claims Rejected Under 35 U.S.C. § 103(a)

The Patent Office rejects claims 1-4, 6-8, 18-23, 25-26, and 28 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,876,271 to Oliver (Oliver) in combination with U.S. Patent No. 5,911,836 to Hada et al. (Hada). To render a claim obvious, all elements of that claim must be taught or suggested by at least one properly combined reference.

Applicants respectfully disagree with the rejection above and submit that independent claim 1, as amended, is patentable over the cited references for at least the reason that the cited references do not teach or suggest “while polishing the metal layer with the first agent, introducing a second agent comprising hydrogen peroxide onto a surface of the metal plug through a polisher; polishing the surface of the metal plug with the second agent, wherein polishing includes driving at least one particle off the surface of the metal plug,” as required by amended independent claim 1. Specifically, according to amended claim 1, for example, while a metal layer is being polished, a particle may be driven off of the surface of a metal plug by polishing the surface with an agent including hydrogen peroxide introduced to the surface of the metal plug through the polisher.

On the other hand, Oliver describes delivering and removing slurry from polishing pad surface through holes formed in a polishing pad surface, where the type of slurry or liquid being delivered to the polishing pad surface can be changed quickly by switching to a different source line. (See col. 10, lines 13-17.) Oliver also describes a quick transition from polishing to rinsing with water accomplished in this manner (see col. 10, lines 17-20). However, one skilled in the art would not conclude that the teaching in Oliver of changing slurries or rinsing the polishing pad surface with water, teaches driving a particle off of a metal plug by polishing the surface using a hydrogen peroxide solution introduced through a polisher, while polishing a metal layer.

Consequently, the Patent Office has not identified and Applicants are unable to find any description or teaching in Oliver of introducing water or hydrogen peroxide through a polisher to a surface of a wafer and driving at least one particle off of the

surface, with the solution, while a metal layer is being polished. Specifically, the portion of Oliver cited by the Patent Office teaches using water to rinse a slurry from a polishing pad surface, but does not describe introducing water or hydrogen peroxide to a surface of a wafer, such as during polishing. (See col. 10, lines 15-19.)

In addition, Hada describes using hydrogen peroxide to remove portions of a photoresist but does not teach polishing. (See col. 3, lines 40-62; col. 4 lines 12-15; and col. 6, lines 24-28.) Specifically, Hada refers to processing steps for forming a semiconductor device that are related to applying a conductive metal film, applying a photoresist on the conductive metal film, and removing the photoresist (see Abstract), but does not teach introducing an agent through a polisher.

Consequently, the Patent Office has not identified and Applicants are unable to find any description or teaching in Hada of driving a particle off of a surface with an agent introduced through a polisher during polishing, as required by amended independent claim 1. Hence, since neither Oliver, Hada, nor the combination teach introducing hydrogen peroxide through a polisher to a surface of a metal plug, polishing the surface with the hydrogen peroxide, and driving a particle off of the surface while polishing a metal layer with a different agent, Applicants respectfully request the Patent Office withdraw the rejection cited above of amended independent claim 1.

Moreover, Applicants respectfully disagree with the rejection above and submit that independent claim 1 is patentable over the cited references for at least the reason that Oliver cannot be properly combined with Hada. Oliver teaches an apparatus for polishing thin film formed on a semiconductor substrate using a polishing pad and slurry (see Abstract). On the other hand, Hada teaches a method of removing photoresist film 4 without entirely removing sidewall protective film 5. (See Figure 2 and Tables 1-3.) In addition, Hada teaches that the conductive metal film, such as aluminum wiring body 3, between the sidewall protective film 5, is not corroded (see col. 3, lines 36-40 and col. 4, lines 4-9).

Thus, the polishing technology of Oliver cannot be combined with the cleaning technology of Hada because the polishing of Oliver would destroy the sidewall

protective film 5 and aluminum wiring body 3 of Hada. Similarly, the compounds and liquids of Hada cannot be applied to the polishing technology of Oliver because none of the compounds or liquids in Hada are described as polishing agents applicable to Oliver. Thus, applying the compounds of Hada to Oliver would not provide any polishing, and applying the polishing technology of Oliver to Hada would corrode, or destroy the conductive metal film of Hada. Since the combination would defeat the principle of operation of either or both Oliver or Hada, the combination is improper (see MPEP § 2145.X.D). Hence, for this second reason, Applicants respectfully request the Patent Office withdraw the rejection above of independent claim 1.

In addition, Applicants assert that the combination of Oliver and Hada is the result of impermissible hindsight in accordance with MPEP § 2145.X.A. Specifically, Hada does not mention, suggest, or motivate the polishing of structures mentioned therein, as would be necessary to motivate combination with Oliver. Similarly, Oliver does not mention, suggest, or motivate cleaning a photoresist from a semiconductor device during polishing, as would motivate combining Hada with Oliver. Therefore, Applicants can only conclude that the Patent Office's cited motive to "combine the teachings of the Oliver and Hada et al. to enable the surface metal rising step of Oliver to be performed," includes knowledge gleaned only from Applicants' disclosure. Hence, for at least this third reason, Applicants respectfully request the Patent Office withdraw the above rejection of independent claim 1.

Applicants submit that claims 3-4, 6, and 8, being dependent upon allowable base claim 1, as amended, are patentable over the cited references for the reasons stated above. Thus, Applicants respectfully request the Patent Office withdraw the rejection of dependent claims 3-4, 6, and 8 as being unpatentable over the cited references.

Next, Applicants respectfully disagree with the rejection of independent claim 18 and submit that claim 18, as amended, is allowable for at least the reason that the cited references do not teach "while polishing the metal layer, spraying a rinsing solution comprising hydrogen peroxide into the conductive plug; or wherein spraying includes driving at least one particle off the surface of the metal plug with the rinsing agent," as required by amended claim 18. Specifically, according to amended claim 18, for

example, a particle may be driven off of a surface by spraying a solution of hydrogen onto the surface during polishing of the surface.

On the other hand, Oliver describes changing slurries on and rinsing a surface of a polishing pad through holes in the pad, but does not teach introducing hydrogen peroxide onto a wafer surface during polishing, as noted above with respect to claim 1. Consequently, the Patent Office has not identified and Applicants are unable to find any teaching in Oliver of spraying a hydrogen peroxide solution onto a conductive plug, or driving a particle off of a surface of a conductive plug with the solution while polishing a metal layer, as required by amended claim 18.

Similarly, Hada teaches cleaning a photoresist from a conductive metal film while leaving a sidewall protective film, but does not teach polishing, as described above with respect to claim 1. Consequently, the Patent Office has not identified and Applicants are unable to find any teaching in Hada of driving a particle off of a surface while polishing a metal layer, as required by amended independent claim 18.

Since neither Oliver, Hada, nor the combination teach or suggest spraying a rinsing solution of hydrogen peroxide or driving a particle off of a surface of a plug with the hydrogen peroxide, while polishing a metal layer, Applicants respectfully request the Patent Office withdraw the rejection of claim 18 identified above.

Second, Applicants request that the rejection of claim 18 identified above be withdrawn for the reason that Oliver and Hada cannot be properly combined for the two reasons noted above with respect to claim 1.

Applicants submit that dependent claims 19-22 being dependent upon allowable base claim 18, as amended, are patentable over the cited references for at least the reasons explained above. Thus, Applicants respectfully request the Patent Office withdraw the rejection of dependent claims 19-22 cited above.

Furthermore, Applicants respectfully disagree with the rejection above and submit that independent claim 23, as amended, is patentable over the cited references for at least the reason that the cited references do not teach or suggest "while polishing the metal layer, spraying a second agent comprising hydrogen peroxide onto the

surface of the metal plug, wherein spraying includes driving at least one particle off the surface of the metal plug with the second agent,” as required by amended claim 23. Arguments provided above for claim 18 apply to claim 23 as well. Thus, Applicants respectfully request that Patent Office withdraw the rejection of amended independent claim 23 for at least the reasons given above with respect to claim 18.

Additionally, Applicants respectfully disagree with the rejection above of independent claim 25 and submit that independent claim 25, as amended, is patentable over the cited references for at least the reason that the cited references do not teach “while polishing a metal layer, introducing a rinsing solution comprising hydrogen peroxide into the conductive plug through a polisher, wherein introducing includes driving at least one particle off the surface of the metal plug using the polisher,” as required by amended independent claim 25. Arguments described above with respect to claim 1 apply to claim 25 as well. Hence, Applicants respectfully request the Patent Office withdraw the rejection of amended independent claim 25 for at least the same reasons as given above with respect to independent claim 1.

Moreover, Applicants respectfully disagree with the rejection above and submit that independent claim 26, as amended, is patentable over the cited references for at least the reason that the cited references do not teach “while polishing the metal layer, introducing a second agent consisting of hydrogen peroxide and water onto the surface of the metal plug, wherein introducing includes one of spraying the second agent onto the surface and introducing the second agent onto the surface through a polisher; and wherein introducing includes driving at least one particle off the surface of the metal plug with the second agent,” as required by amended independent claim 26. Arguments above for claims 1 and 18 apply to independent claim 26 as well. Hence, Applicants respectfully request the Patent Office withdraw the rejection above for independent claim 26.

Finally, Applicants respectfully disagree with the rejection above and submit that independent claim 28 is patentable over the cited references for at least the reason that the cited references do not teach “while polishing the metal layer, introducing a rinsing solution onto the conductive plug, the rinsing solution consisting of hydrogen peroxide

and water wherein introducing includes one of spraying the solution onto the surface and introducing the solution onto the surface through a polisher; wherein introducing includes driving at least one particle off the surface of the metal plug with the solution," as required by independent claim 28. The arguments for claims 1 and 18 above apply to claim 28 as well. Therefore, Applicants respectfully request the Patent Office withdraw the rejection cited above of amended independent claim 28.

CONCLUSION

In view of the foregoing, it is believed that all claims now pending (1) are in proper form, (2) are neither obvious nor anticipated by the relied upon art of record, and (3) are in condition for allowance. A Notice of Allowance is earnestly solicited at the earliest possible date. If the Examiner believes that a telephone conference would be useful in moving the application forward to allowance, the Examiner is encouraged to contact the undersigned at (310) 207-3800.

If necessary, the Commissioner is hereby authorized in this, concurrent and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2666 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17, particularly, extension of time fees.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

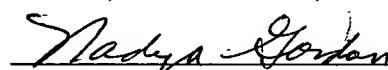
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